

# The Collection Method in a Second Order Perspective

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One of the fruitful contributions developed by P. Miglioli to the study of constructive logical systems has been the so-called *Collection Method*.

It is a general technique which provides a formal construction enabling the extraction of information from the formal proofs developed inside a logical system  $\mathcal{S}$ . The method is complemented by a proof pattern which permits to develop a series of meta-theorems, showing some relevant properties of the logical system  $\mathcal{S}$  by analyzing the structure of the information which gets extracted from the formal proofs of  $\mathcal{S}$ .

The analysis of the extracted information permits to identify the notion of strongly constructive formal systems [Fer97], which is strictly related to the works on datatypes and the synthesis of programs P. Miglioli and his group developed in the last twenty years.

Unfortunately, due to its nature of *recipe*, the Collection Method is not as known as others results of P. Miglioli, although traces of its application can be found here and there in most of the published studies of the research group. The most explicit treatment of this method ever published is in [MO81].

The Collection Method has been successfully applied to many intermediate logics as well as to many general classes of mathematical theories, all of them formalized in the context of first-order logical systems.

A natural extension would have been the study of second-order logical systems but, despite many attempts [Ber98, Ben99], no definitive result in this direction is still available.

The importance of the applications of the Collection Method to higher-order logical systems lies in the recent developments on the formal verification, analysis and synthesis of computer programs in a constructive perspective [Ben00].

In this contribution, the state of the research about the application of the Collection Method to second-order logical systems is discussed. In particular, some new results are shown, establishing the strongly constructive character of large fragments of logical systems derived from second-order intuitionistic logic.

## References

- [Ben99] M. Benini. The collection method in second-order intuitionistic logic. Technical Report 237-99, Dipartimento di Scienze dell'Informazione, Università degli Studi di Milano, 1999.
- [Ben00] M. Benini. *Verification and Analysis of Programs in a Constructive Environment*. PhD thesis, Dipartimento di Scienze dell'Informazione, Università degli Studi di Milano, January 2000.
- [Ber98] G. Bertolotti. *Extracting Information from Proofs of Constructive Second Order Systems*. PhD thesis, Dipartimento di Scienze dell'Informazione, Università degli Studi di Milano, 1998.
- [Fer97] M. Ferrari. *Strongly Constructive Formal Systems*. PhD thesis, Dipartimento di Scienze dell'Informazione, Università degli Studi di Milano, 1997.
- [MO81] P. Miglioli and M. Ornaghi. A logically justified model of computation. *Fundamenta Informaticæ*, IV(1,2), 1981.